U.S. Army Research Institute
for the Behavioral and Social Sciences

Research Report 1509

Evaluation of the Hand-Held Mathematics Tutor

Joan Harman and Sally A. Bell
U.S. Army Research Institute

Neil Laughy
Education Center
Fort Sill, Oklahoma

February 1989

U.S. ARMY RESEARCH INSTITUTE FOR THE BEHAVIORAL AND SOCIAL SCIENCES

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EDGAR M. JOHNSON
Technical Director

JON W. BLADES
COL, IN
Commanding

Technical review by

Judith E. Brooks
V. Melissa Holland

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This report describes the evaluation of the Hand-Held, Computerized Mathematics Tutor that was developed to teach job-related mathematics to Combat Engineers. Twenty-seven Combat Engineers stationed at Fort Sill, Oklahoma, participated in the research. Pre- and post-tests of their mathematics skills were administered, as well as a questionnaire to determine their attitudes toward the tutor. Analysis revealed that the tutor improved soldiers' mathematics skills, with the magnitude of the improvements corresponding to the number of hours spent using the tutor. Participants liked the tutor, found it easy to use, and preferred it to mathematics instruction by textbook.

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Evaluation of the Hand-Held Mathematics Tutor

Joan Harman and Sally A. Bell
U.S. Army Research Institute

Neil Laughy
Education Center
Fort Sill, Oklahoma

Technologies for Skill Acquisition and Retention Technical Area
Zita M. Simutis, Chief

Training Research Laboratory
Jack H. Hiller, Director

U.S. Army Research Institute for the Behavioral and Social Sciences
5001 Eisenhower Avenue, Alexandria, Virginia 22333-5600

Office, Deputy Chief of Staff for Personnel
Department of the Army

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Education and Training

FOREWORD

The Technologies for Skill Acquisition and Retention Technical Area of the U.S. Army Research Institute for the Behavioral and Social Sciences (ARI) performs research and development in education as part of its work program. A major focus of this research is the development of technologies to enhance soldiers' basic skills. The research described in this report was conducted under Project A794, Education and Training, as part of Task 313, Improving Job Skills Education for Soldiers.

This report describes research carried out to determine the effectiveness of ARI's Hand-Held Computerized Mathematics Tutor. This version of the tutor was developed to teach and/or refresh mathematics skills of Combat Engineers who are selected to enroll in the Non-Commissioned Officer Education System (NCOES). Combat Engineers at Fort Sill, Oklahoma, participated in the evaluation. Findings indicated that the Mathematics Tutor improved participants' skills, with the magnitude of the improvements corresponding to the amount of time spent using the tutor. These findings will become part of ARI's body of research on improving the academic skills of noncommissioned officers.

The research activities described in this report were supported by the Soldier Education Division, Total Army Personnel Agency, Office of the Deputy Chief of Staff for Personnel. The Soldier Education Division and the Education Services Officer and Battery Commanders of the 299th Combat Engineers Battalion at Fort Sill were briefed about the results of this research. The Battery Commanders will continue to use the Mathematics Tutor to provide mathematics instruction for NCOES candidates.

EDGAR M. JOHNSON
Technical Director

EVALUATION OF THE HAND-HELD MATHEMATICS TUTOR

EXECUTIVE SUMMARY

Requirement:

The disparity between job demands and soldiers' entry-level skills is of concern to the Army. The development and implementation of increasingly complex weapons and communications systems and the projected decline in the prime accession age group during the next decade necessitate development of training methods to reduce the disparity. The U.S. Army Research Institute for the Behavioral and Social Sciences (ARI) has responded to this need by developing a portable, hand-held, computerized mathematics tutor that teaches technical, job-related subject matter.

Procedure:

Twenty-seven noncommissioned officers who are Combat Engineers and who were stationed at Fort Sill, Oklahoma, participated in the evaluation of the Mathematics Tutor. They were requested to work with the tutor for 1 hour a day for 6 days or until mastery of the subject matter was achieved. A short Preview was administered to determine levels of mathematics skills prior to using the tutor and, following 6 days' time, a questionnaire and a Review were administered to determine soldiers' attitudes toward the tutor and to measure any changes in mathematics skills.

Findings:

The tutor improved soldiers' mathematics skills. The magnitude of improvement corresponded to the number of hours they spent using the tutor. The participants liked the tutor, found it fairly easy to use, and preferred it to mathematics instruction by textbook.

Utilization of Findings:

The findings make a substantive contribution to the body of knowledge that ARI is developing, through research, to improve academic skills of NCOs.

EVALUATION OF THE HAND-HELD MATHEMATICS TUTOR

CONTENTS

LIST OF FIGURES

EVALUATION OF THE HAND-HELD MATHEMATICS TUTOR

BACKGROUND

The U.S. Army has been developing and implementing increasingly complex and sophisticated weapons and communications systems. At the same time, the Army has been required to train great numbers of newly inducted soldiers who demonstrate widely varying ability levels. According to Duffy (1985), "Armed forces personnel must operate and maintain some of the most sophisticated, costly and dangerous equipment in existence." This situation is expected to be exacerbated by demographic projections to the year 2000. They predict a substantial decrease in the prime accession age group during the next decade (Bureau of the Census, 1983/84; Sticht and Mikulecky, 1984; Binkin, 1986). This reduction in the recruitment pool could result in pressure to lower recruitment standards, thus increasing the gap between job demands and skill levels. What is needed are flexible and innovative training methods that reduce the disparity between high-tech job requirements and soldiers' entry-level skills. The U.S. Army Research Institute for the Behavioral and Social Sciences (ARI) has addressed this need by developing a portable, hand-held, computerized tutor that teaches technical, job-related subject matter.

Traditionally, computer-based instructional systems consisted of desk top devices that were very costly and were confined to a site to which users were also confined in order to benefit from the instruction. However, advances in semiconductor technology have made possible the development of hand-held training aids that can accompany users to a variety of living and working areas (Wisher, 1987). Francis and Levey (1982) evaluated ten hand-held computers as low-cost training aids and reported that they were effective in a variety of training areas.

ARI's Hand-Held Tutor

Figure 1 is a depiction of the Hand-Held Tutor.

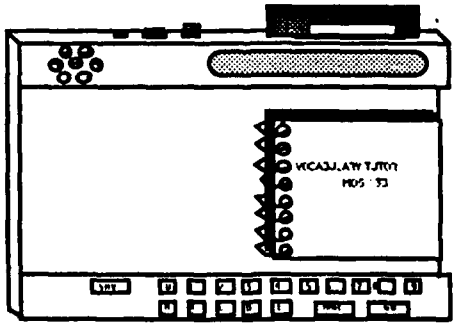

Figure 1. The Hand-Held Computerized Tutor

The four-pound, battery-operated, computerized training aid was developed for use in soldiers' out-of-classroom environments (mess halls, motorpools, barracks, etc.) to convert lull time into training opportunities. Each soldier, therefore, can work with a tutor independently in a variety of settings rather than sharing a terminal at a fixed location. The tutor also incorporates the following features:

- diagnostic pretests
- self-paced instruction
- gaming
- instruction compatible with varying initial knowledge levels
  initial motivation levels
  rates of learning
- frequent corrective feedback

Exterior Features of the Tutor

The exterior features of the tutor include a 9" by 11" (22.5 cm x 27.5 cm) plastic case with an indentation molded on its top surface to hold a 5" by 5" (12.5 cm x 12.5 cm) booklet that provides instruction and directions for interacting with the computer. Above the booklet is a multifunction liquid crystal diode display screen that includes a two digit counter and twenty-nine character space for questions, instructions, definitions and feedback. Below the booklet is a keyboard equipped with domed conductors to provide tactile feedback to the user. The keyboard displays numerals 0 through 9, letters A through E, and the words SAY, ERASE, and GO. Beside the display screen on the upper front surface of the tutor is a built-in speaker and, in the rear, a jack for alternative earphones. Also on the back of the tutor casing is a jack for a battery recharger, a switch/volume control, and a receptacle for plug-in modules that encase a computer chip programmed for the Military Occupational Specialty (MOS) instruction provided in the accompanying courseware booklet. The plug-in nature of the module offers the potential to permit the essential hardware features to accommodate a great variety of MOS instruction.

Selections of all features of the tutor were based on cost, availability and human factors considerations. For example, the display screen was chosen to optimize brightness, contrast ratio, size, character font and legibility within size and cost constraints. The printed

courseware booklet represents an economical alternative to systems that store text and graphics in computer memory for display on a CRT (Harman, 1985).

Hardware and Software

The tutor contains two ROMs; a 4k by 8 bit ROM to run the software and a 228 kilobit ROM for the speech capability. The tutor does not have external RAM. However, its internal registers are 64 bytes. The central processing unit is an RCA 1802 C-MOS 8 bit processor. The printed circuit board is fiberglass epoxy laminate, printed on both sides, and has plated-through holes. The speech system is the Texas Instruments 5220 linear predictive coding system with higher fidelity than the phoneme technique. The keyboard is a matrix switch, printed circuit technique with an embossed mylar overlay for key identification and protection. The intelligent display is equipped with on-board memory and display drivers. The earphone attachment is a low impedance, single earphone similar to those used with transistor radios. The tutor is powered by three D cell rechargeable nickel cadmium batteries. The information for the display and speech are contained in a plug-in ROM pack containing a printed circuit board with chips of 2k for display and 228 kilobits for speech (Berkowitz & Simutis, 1983).

Courseware

The major considerations in courseware development included multiple teaching techniques (gaming, drill and practice, etc.) to maximize a match with individual learning styles, initial knowledge levels and rates of learning. Users can make selections from a menu of teaching/testing options that include gaming. The booklet includes graphic presentations and the computer provides both immediate and delayed visual and oral feedback in response to multiple choice questions.

The courseware is divided into units that are sequenced from less to more difficult material to promote an early experience of success by the users. Each unit consists of a Pretest, Explanation, Picture Battle and Word War. Users can choose any unit to work with and any component within the unit selected.

Pretests. These are short tests that are intended to establish whether the user is knowledgeable about the subject matter being presented. If all but one or if every question is answered correctly, the final score is presented vocally and the user is permitted to move to any other component or any other unit or, if desired, to review the Pretest. If more than one answer is wrong, the user is directed to return to the first Pretest item, review the test with accompanying

corrective feedback, and then is directed to the Explanation component.

Explanation. This is the componen in which the basic subject matter is taught. Also, this component includes test questions as a check on the progress of the instruction.

Picture Battle. This component requires matching graphic presentations with visual/oral stimuli. The booklet accompanying the mathematics tutor presents problems in computation with multiple choice answers. At each end of the display screen, projectiles appear that represent friendly and enemy targets. Correct responses result in movement of the friendly projectile toward the enemy target and incorrect responses result in the same kind of movement of the enemy projectile. The objective is to destroy the enemy target before it reaches the friendly one. The impact with the enemy target is accompanied by a sound resembling an artillery shell exploding. The impact with the friendly target only results in both projectiles returning to starting positions to re-start the game.

Word War. This component is independent of the booklet. Both questions and multiple choice answers are presented by the computer in the form of electronic flash cards on the display screen. The instructional method calls for drill and practice in an increasing ratio review format. That is, incorrect responses result in the question being presented again after one succeeding question, and once again after three additional items have been presented. Multiple choice answers to questions answered incorrectly are randomly selected from other choices stored in the tutor's chip. Also, the position of the correct answer choice is randomly varied. The success of increasing ratio review has been demonstrated to shift learned information from short to long term memory.

The tutor, therefore, incorporates varying teaching techniques, presentation modes and kinds of feedback in order to enhance acquisition and retention of the selected subject matter. The courseware is heavily weighted with frequent, short tests to permit the user to monitor progress in acquiring the needed information and to focus attention on the most relevant materials.

Applications of the Hand-Held Tutor

The initial development, under contract with Franklin Research Center, was for a tutor to teach Cannon Crewmen technical vocabulary. Next, the tutor was adapted to teach job related mathematics to Combat Engineers, and the final adaptation was to teach degraded mode gunnery to Tank Commanders. The contractor also developed a RS-232-C serial interface for the tutor. This provides a hardware/software

data link through which the tutor can communicate with other computers. A desk top microcomputer can download course materials to the tutor, which can then be disconnected and transported to another site for study. A diagnostic feature allows for the microcomputer to upload responses to test questions, assess the needs of the user, then download appropriate homework on which the user can practice before returning for retesting. This development greatly increases the flexibility of the tutor and provides the potential for storing instructional materials for a variety of MOS, each set of which can be transferred to the portable device as needed.

The remainder of this report describes evaluation of the version of the tutor that teaches job related mathematics to Combat Engineers. The curriculum includes instruction in basic addition, subtraction, multiplication, and division as well as fractions, decimals, basic algebra, ratio, proportion, and formulas for timber cutting and road cratering. Although most of the curriculum covers fairly general mathematics, all of the instruction was selected to serve, in particular, Combat Engineers who are required to pass the mathematics screening test to become noncommissioned officer candidates.

METHOD

Pilot Study

In order to test and refine the instruments developed for this evaluation, ARI staff members conducted a pilot study involving service members attending classes in explosive ordnance disposal at the Naval Ordnance Station located in Indianhead, Maryland. Three classes, each between 18 and 22 students, participated. The pre- and post-mathematics tests (called the Preview and the Review), together with the questionnaire, were tried out and revised as needed.

Formal Evaluation

Design. A two group, time series design, using subjects as their own controls, was selected for this research.

Subjects. Twenty-seven Combat Engineers stationed at Fort Sill, Oklahoma, volunteered to participate in this research. Most of the soldiers (76%) who participated in the evaluation held the rank of Sergeant, E-5 (range = E-4 through E-7). Average time served in the Army was 7 years (range 1 to 16 years). All had high school diplomas or the equivalency, and some had college experience (40%), although none had completed a 4-year undergraduate program.

Procedure. Education Center staff members at Fort Sill, Oklahoma, provided oversight for the evaluation of the mathematics tutor. Each soldier was informed that participation was voluntary and that no information about any individual participating would be given to any supervisor or would become part of any soldier's records. Then the functions of the tutor were demonstrated. Soldiers were requested to work with the tutor for 1 hour a day for 6 days or until mastery of the subject matter being studied was achieved. Finally, participants were informed that they would be given a short Preview to determine their mathematics skill levels and, following their use of the tutor, a questionnaire followed by a Review to measure any change in mathematics skills (see Appendix).

RESULTS

Pilot Study

The only remarkable result of our pilot effort was that, in the classes we dealt with, a number of students spontaneously informed us that they had strong negative feelings about mathematics. In light of the fact that the groups who had been presented with the vocabulary and tank tutors expressed no similar sentiments, we surmised that the effectiveness of the mathematics tutor might be diminished as a result of uncontrollable motivational factors.

Tutor Effects

Two groups of Combat Engineers, separated by several months' time, participated in the evaluation during 1988. An important factor that distinguished the two groups was the time each spent working with the tutor. No factors, other than time of participation and time spent on the tutor, distinguished the two groups. The earlier group (n = 19) used the tutor for an average of 1.37 hours over 6 days' time (range = <1 to 3 hours), whereas the later group (n = 8) used the tutor for an average of 4.53 hours over 6 days' time (range = 3.24 to 6.50 hours). The gains in mathematics skills parallel the amounts of time spent using the tutor. The mean gain for the short time group was 14.7% compared to the mean gain for the longer time group at 30.36%. Soldiers in the short time group who demonstrated no skill gains were those who used the tutor for periods of 1 hour or less. All soldiers in the longer time group showed skill improvement. Figure 2 shows percent gains by hours spent on the tutor.

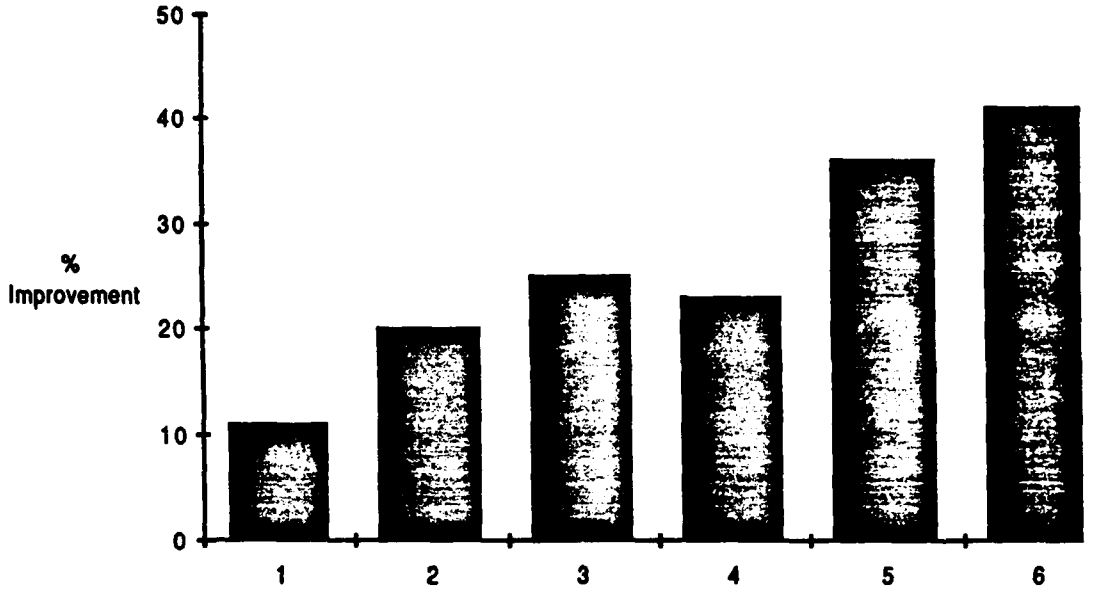

Figure 2. Hours Using the Tutor

Questionnaire Responses

Participants were asked what areas of mathematics taught by the tutor they needed to do their jobs. The percent of participants who reported they needed these skills were: basic arithmetic 80% fractions 88%, decimals 80%, algebra 52%, ratio 64%, proportion 52%,and formulas 80%. When asked what additional mathematics-related job tasks it would be useful to include in the tutor, one soldier suggested formulas for steel cutting charges. All participants found it very to moderately easy to use the tutor and only about half of them reported that they asked for some kind of help to use it. The short time group responded with much greater frequency than did the longer time group concerning their absence of familiarity with the areas of mathematics taught by the tutor. In addition, whereas the longer time group shifted the great majority of their responses from the somewhat familiar column to the very familiar column after they had spent time on the tutor, the short time group continued to indicate some unfamiliarity with the more demanding mathematics areas covered by the tutor--algebra, ratios, proportions and formulas--albeit the number of these responses declined sharply (26 to 9).

When participants were asked if they preferred learning mathematics from the tutor or classroom lectures, both groups selected lectures as frequently as they selected the tutor. When asked if they would prefer to learn from a mathematics

textbook or the tutor, the great majority preferred the tutor (18 to 4). The soldiers also, almost without exception, acknowledged that the tutor was helpful in improving their mathematics skills.

Open ended questions were included in the questionnaire that requested the soldiers to report what features of the tutor they liked best and what features they liked least. The most frequent response to what features were best liked was "all of them." Other features mentioned were feedback, self-pacing, the option to review units, ease of operation and easily understandable subject matter. Features liked least included Word War, the lack of a unit on formulas for steel cutting charges,that the subject matter needed to be more difficult and that there was no reset option on the tutor.

In response to a request for comments concerning the tutor, those who elected to comment were overwhelmingly positive. They remarked that it was "very helpful in the learning process," that it was "a great machine," that it was "a great experience," that it "refreshes one's memory about mathematics," and that its "full potential could be realized when it is used in conjunction with classroom instruction."

DISCUSSION

ARI's Hand-Held Computerized Mathematics Tutor improved soldiers' mathematics skills. Our evaluation demonstrated that the more time soldiers spent on the tutor, the greater skill improvement tended to be. Participants reported that the tutor was fairly easy to use, that they valued it to the same degree as they valued classroom lectures and preferred the tutor to textbooks. Some soldiers used the tutor for relatively short periods of time--one hour or less. These participants tended to show lower gains in skill level and, in three instances, no gain at all. It may be the case that time on task in mathematics instruction is influenced by aversion to the subject matter.

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APPENDIX

MATH PREVIEW

Write the answer on the line to the right of each item. You may use space on the right for your calculations.

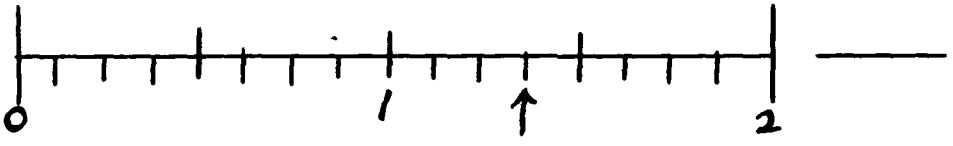
1) 6047 + 309 = _____

2) 7150 - 374 = _____

3) 1605 x 890 = _____

4) 2177 ÷ 70 = _____

In problems # 5 and 6, write the number the pointer indicates.

5) 

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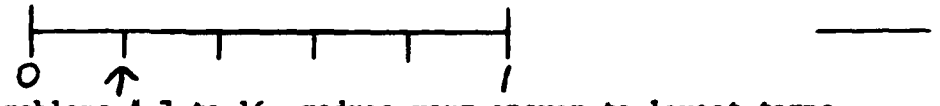
6) 

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In problems # 7 to 16, reduce your answer to lowest terms.

7) $\frac{3}{6}$ = _____

8) $\frac{18}{18}$ = _____

9) $\frac{10}{12}$ = _____

10) $\frac{7}{8} + \frac{1}{7}$ = _____

11) $\frac{5}{8} - \frac{1}{3} =$ _____

12) $\frac{1}{3}$ of $\frac{1}{4} =$ _____

13) $\frac{3}{4} \times 16 =$ _____

14) $\frac{6}{7} \times \frac{5}{8} =$ _____

15) $\frac{3}{4} - \frac{1}{2} =$ _____

16) $\frac{6}{7} - 4 =$ _____

17) $6.39 + 4 =$ _____

18) $8.905 + 2.07 + 4.3 =$ _____

19) $9.792 - 4 =$ _____

20) $6 - .1 =$ _____

21) $7.1 - 1.37 =$ _____

22) $13.75 \times 1.2 =$ _____

23) $.14 \times .4 =$ _____

24) $.09 - 3 =$ _____

25) $4 - .002 =$ _____

26) $59.5 - .35 =$ _____

27) .2048 - .64= _____

In problems # 28 to 30, add algebraically and write the answers below each item.

28) $\begin{array}{r} -14 \\ +\ 9 \\ \hline \end{array}$

29) $\begin{array}{r} -13 \\ -\ 7 \\ \hline \end{array}$

30) $\begin{array}{r} +\ 2 \\ -\ 7 \\ \hline \end{array}$

In problems # 31 to 33, subtract algebraically and write the answers below each item.

31) $\begin{array}{r} -\ 7 \\ -\ 2 \\ \hline \end{array}$

32) $\begin{array}{r} -\ 2 \\ +\ 10 \\ \hline \end{array}$

33) $\begin{array}{r} +\ 3 \\ -\ 8 \\ \hline \end{array}$

In problems # 34 to 36, solve for N.

34) $\frac{3}{4} = \frac{N}{100}$ N = _____

35) $\frac{12}{N} = \frac{3}{16}$ N = _____

36) $\frac{N}{7} = \frac{5}{6}$ N = _____

In problems # 37 to 42, if a = 3 and b = 4, solve for y.

37) $y = a+b$ y = _____

38) $y = ab$ y = _____

39) $y = \frac{a}{b}$ y = _____

40) $y = a^b$ y = _____

41) $y = a^2$ y = _____

42) $y^2 = b$ y = _____

MATH REVIEW

Write the answer on the line to the right of each item. You may use space on the right for your calculations.

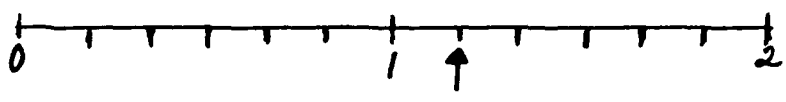
1) 76Ø4 + 7Ø8 = _____

2) 624Ø - 475 = _____

3) 17Ø4 x 78Ø = _____

4) 318Ø ÷ 8Ø = _____

In problems # 5 and 6, write the number the pointer indicates.

5) 

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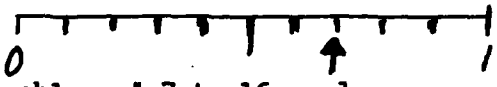
6) 

_____

In problems # 7 to 16, reduce your answer to lowest terms.

7) $\frac{3}{12}$ = _____

8) $\frac{2Ø}{2Ø}$ = _____

9) $\frac{14}{16}$ = _____

10) $\frac{8}{9} + \frac{1}{6}$ = _____

11) $\frac{7}{9} - \frac{1}{4}$ = _____

12) $\frac{1}{4}$ of $\frac{1}{5}$ = _____

13) $\frac{4}{5} \times 20$ = _____

14) $\frac{7}{9} \times \frac{3}{4}$ = _____

15) $\frac{2}{3} \div \frac{1}{3}$ = _____

16) $\frac{4}{5} \div 3$ = _____

17) 8.67 + 3 = _____

18) 9.402 + 3.04 + 3.1 = _____

19) 8.237 - 3 = _____

20) 5 - .2 = _____

21) $6.2 \cdot 3.45 =$ _____

22) $14.25 \times 2.1 =$ _____

23) $.22 \times .3 =$ _____

24) $.08 \div 2 =$ _____

25) $9 \div .003 =$ _____

26) $47.5 \div .25 =$ _____

27) $.2173 \div .53 =$ _____

In problems # 28 to 30, add algebraically and write the answers below each item.

28) -17 / $+10$

29) -12 / -7

30) $+4$ / -8

In problems # 31 to 33, subtract algebraically and write the answers below each item.

31) -9 / -3

32) -4 / $+11$

33) $+2$ / -9

In problems # 34 to 36, solve for N.

34) $\frac{7}{8} = \frac{N}{160}$ N = _____

35) $\frac{16}{N} = \frac{4}{13}$ N = _____

36) $\frac{N}{6} = \frac{8}{9}$ N = _____

In problems # 37 to 42, if a = 3 and b = 4, solve for y.

37) $y = a-b$ $y =$ _____

38) $y = ba$ $y =$ _____

39) $y = \frac{b}{a}$ $y =$ _____

40) $y = b^a$ $y =$ _____

41) $y = b^2$ $y =$ _____

42) $y^2 = 25$ $y =$ _____

U.S. ARMY RESEARCH INSTITUTE

MATHEMATICS TUTOR

QUESTIONNAIRE FOR SERVICE MEMBERS

PRINCIPAL PURPOSE(S):

The data collected with the attached form are to be used for research.

ROUTINE USES:

This is an experimental personnel data collection form developed by the U.S. Army Research Institute for the Behavioral and Social Sciences pursuant to its research mission as prescribed in AR 70-1. When identifiers (name or Social Security Number) are requested they are to be used for administrative and statistical control purposes only. Full confidentiality of the responses will be maintained in the processing of these data.

MANDATORY OR VOLUNTARY DISCLOSURE AND EFFECT ON INDIVIDUAL NOT PROVIDING INFORMATION:

Your participation in this research is strictly voluntary. Individuals are encouraged to provide complete and accurate information in the interests of the research, but there will be no effect on individuals for not providing all or any part of the information. This notice may be detached from the rest of the form and retained by the individual if so desired.

DATE_____

LAST NAME (Please print)_____ FIRST NAME_____

SOCIAL SECURITY NO._____

BRANCH OF SERVICE_____ RANK_____

TIME IN SERVICE_____ JOB TITLE_____

1. What is your highest education level?

   Completed elementary school _____

   High school graduate _____

   GED Certificate _____

   Some college, no degree _____

   Associate Degree _____

   Bachelor's Degree _____

2. What areas in math do you need to know to do your job?

   Basic addition, subtraction, multiplication and division _____

   Fractions _____

   Decimals _____

   Basic Algebra _____

   Ratio _____

   Proportion _____

   Formulas _____

   Other (Write in) _____

3. How many total hours did you spend working with the Mathematics Tutor?

_____

4. How easy did you find it to use the Tutor?

Very Easy	Moderately Easy	Difficult
_____	_____	_____

5. How familiar were you with the following subjects before you worked with the Mathematics Tutor?

	Unfamiliar	Somewhat Familiar	Very Familiar
Fractions	_____	_____	_____
Decimals	_____	_____	_____
Algebra	_____	_____	_____
Ratios	_____	_____	_____
Proportions	_____	_____	_____
Formulas	_____	_____	_____

6. Which of the following subjects that the Tutor offers did you use to improve your math skills?

Fractions	_____
Decimals	_____
Algebra	_____
Ratios	_____
Proportions	_____
Formulas	_____
All of them	_____

7. How familiar are you with these subjects now that you have worked with the Mathematics Tutor?

	Unfamiliar	Somewhat Familiar	Very Familiar
Fractions	_____	_____	_____
Decimals	_____	_____	_____

Algebra	_____	_____	_____
Ratios	_____	_____	_____
Proportions	_____	_____	_____
Formulas	_____	_____	_____

8. While you are working with the Mathematics Tutor, how often did you ask another person for help?

Never	Once in a While	Very Often
_____	_____	_____

9. If you did find it necessary to ask another person for help, with what part of the Mathematics Tutor did you need help?

General Directions	_____
Pretests	_____
Explanations	_____
Picture Battle	_____
Word War	_____
Fractions	_____
Decimals	_____
Algebra	_____
Ratios	_____
Proportions	_____
Formulas	_____

10. Would you rather learn math from classroom lectures or from the Tutor?

Lectures	Tutor
_____	_____

11. Would you rather learn math from a textbook or from the Tutor?

Textbook	Tutor
_____	_____

12. How helpful was the Tutor in improving your math skills?

Very helpful	Somewhat helpful	Not helpful
_____	_____	_____

13. What feature(s) of the Tutor do you like best? _____

_____

_____

14. What feature(s) of the Tutor do you like least? _____

_____

_____

We would be pleased to read any comments you would like to make about the Mathematics Tutor: _____

_____

_____

_____

_____

_____

_____

Thank You